BaseLiner™ enhanced matching and scanner control

The semiconductor industry is driven by “shrink” – the ability to make the features that make up chips ever smaller. Shrink improves chip performance and increases manufacturers’ profitability. However, as chip features get smaller so do the tolerances or “process window” that manufacturers must work to. The smaller the process window the harder it is to manufacture chips that work properly.

Lithography is at the heart of semiconductor manufacturing as it makes feature shrink possible. As a leading lithography supplier, ASML is helping drive the industry forward by introducing an advanced new approach to chip manufacturing called holistic lithography.

A key component of holistic lithography is an increased ability to control lithography scanners. ASML’s new BaseLiner scanner stability product gives manufacturers greater control over their scanner’s focus and overlay (layer-to-layer alignment) uniformity. This leads to an optimized process window for a given feature size and chip application, enabling the continuation of shrink and the creation of more advanced chips.

Scanner stability and higher availability

When a lithography system is first installed, it must be calibrated to ensure optimal operation. However, over time, system performance parameters will drift. A small amount of drift can be tolerated, but too much drift and the system will go out of specification. So manufacturers periodically need to stop production for re-calibration. Calibrating the system more frequently gives a bigger process window, but means more scheduled downtime.

The BaseLiner scanner stability option greatly reduces these production stoppages. Instead, it automatically resets the system to a pre-defined baseline each day. To do this BaseLiner retrieves standard measurements taken on a monitor wafer using a metrology tool such as ASML’s YieldStar systems. The monitor wafer must be exposed using a special BaseLiner reticle containing special scatterometry marks.

From that day’s measurements, BaseLiner determines how far the system has drifted from its baseline. It then calculates wafer-level overlay and focus correction sets. The TWINSCAN system then converts these correction sets into specific corrections for each exposure on subsequent production wafers.

Automated overlay grid matching

Volume production fabs want to have full flexibility when assigning layers for exposure to a scanner. The alternative - layer-scanner dedication - would put monthly fab output capacity at risk, since any small disturbance of the lithocluster directly shows up in the fab output of that month. Today, customers overcome this risk by so called (overlay) grid matching. All scanner grids are intentionally “off-sett“ a little in a way that all scanners more or less have the same (average) grid for overlay. This grid is often referred to as ‘holy’ or ‘golden’ grid. Each product layer can now be exposed on each scanner of the same type. This ‘golden’ grid is exposed and etched onto so called ‘reference wafers’.

Now the efficiency opportunity arises: If customers chose to use these ‘golden’ matching wafers as their baseline for overlay stability control in stead of random monitoring wafers, they now can catch 2 birds with 1 stone. They get overlay grid matching AND long-term stability in 1 automated step.

Key features and benefits

- Long-term focus stability, at customer defined process conditions, without sacrificing scanner productivity
- Long-term matched machine overlay stability, at customer defined process conditions, without sacrificing scanner productivity
- Monitors scanner overlay and focus
- All efficiently integrated into 1 automated step that can be managed via lot operation

Availability

BaseLiner will initially be released for TWINSCAN XT:1700i, XT:1900i and XT:1950i systems on release 4.5. Beta testing will start in December 2009, and is available for ordering as of Q1 2010. Versions for TWINSCAN NXT and dry scanners will be available at a later date.

ASML is making the functionality available in two versions: a software-only module and a complete package including the software, a YieldStar wafer metrology tool, a dedicated BaseLiner server and a BaseLiner reference reticle.
YieldStar, the BaseLiner server and reference reticle can also be purchased separately.

BaseLiner is part of ASML’s application-specific holistic lithography offering known as Eclipse™.